

Appl. No. 09/997,084

Amendment dated March 2, 2004

Reply to Office Action of *November 18, 2003*

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1(currently amended): An infrared lamp comprising:

a carbon-based heating element obtained by the process comprising:

firing a mixture of ~~mixing~~ a carbon composition having compactibility and a carbon yield of substantially nonzero after firing ~~with~~ and at least one kind of metallic or semi-metallic compound to form a carbon-based heating element ~~and then by firing, wherein~~
reheating said carbon-based heating element in a vacuum, to set the change rate of the electric specific resistance of said carbon-based heating element[[,]] at a high temperature in lit state with respect to ~~the~~ electric specific resistance at a normal temperature in unlit state ~~is set~~ in the range from -20% to +20%

lead wires electrically connected to both ends of said carbon-based heating element, and

a sealed quartz glass tube filled with a gas and accommodating said carbon-based heating element so that the ends of said lead wires ~~are extended~~ extend outside said sealed quartz glass tube, ~~said quartz glass tube being filled with an inert gas and sealed.~~

Claim 2(currently amended): An infrared lamp in accordance with claim 1, wherein the metallic or semi-metallic compound included in said carbon-based heating element is at least one ~~kind of~~ compound selected from the group consisting of metallic carbide, metallic boride, metallic silicide, metallic nitride, metallic oxide, semi-metallic nitride, semi-metallic oxide and semi-metallic carbide.

Claim 3(currently amended): An infrared lamp in accordance with claim 1, wherein ~~the composition of~~ said carbon-based heating element includes resins.

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Claim 4 (currently amended): An infrared lamp in accordance with claim 1, wherein ~~the composition of~~ said carbon-based heating element includes at ~~lead~~ least ~~one kind of~~ powder selected from the group consisting of carbon black, graphite and coke powder.

Claim 5 (currently amended): An infrared lamp in accordance with claim 1, wherein said lead wires are electrically connected to ~~the~~ current passing portions of said carbon-based heating element via connection members having an inherent resistance smaller than that of said carbon-based heating element and larger than that of said lead wires ~~, the lead wires are inserted into said quartz glass tube so that the ends thereof are extended outside said quartz glass tube, and said quartz glass tube is filled with an inert gas and sealed.~~

Claim 6 (currently amended): An infrared lamp in accordance with claim 5, wherein said connection members are cylindrical members composed ~~formed~~ of a carbon-based substance and having a slit at one end of the cylindrical member.

Claim 7 (currently amended): An infrared lamp in accordance with claim 5, wherein said lead wire comprises a metal ~~is a metallic wire~~ selected from the group consisting of ~~among~~ a tungsten wire, a molybdenum wire and a stainless steel wire.

Claim 8 (currently amended): An infrared lamp in accordance with claim 5, having wherein a coil spring on at least one of said lead wires to apply a tension to said carbon-based heating element, wherein said coil spring has portion having a diameter almost close substantially equal to the inner diameter of said quartz glass tube ~~is provided on at least one of said lead wires connected to both ends of said carbon-based heating element so as to apply a tension to said carbon-based heating element.~~

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Claim 9 (currently amended): An infrared lamp in accordance with claim 5, wherein said quartz glass tube is filled with a gas selected from the group consisting ~~one~~ of argon, nitrogen and a mixture ~~gas~~ of argon and nitrogen.

Claim 10 (currently amended): An infrared lamp comprising:

a ~~long~~ heating element having a sintered body made of a carbon-based element obtained by connecting comprising a plurality of heating elements ~~[[,]]~~ connected in series via cylindrical connection terminals wherein said cylindrical connection terminals radiate heat and are tightly fitted to said plurality of heating elements at a recess, ~~said heating elements being formed of a sintered body including a carbon-based substance,~~

electrode terminals connected to both ends of said ~~long~~ heating element, and

a heating element assembly ~~obtained by electrically connecting one ends of comprising~~ internal lead wires connected on one end to said electrode terminals and ~~by connecting the other ends of said internal lead wires connected on another end to one ends end of an~~ intermediate terminal ~~plates~~ plate.

Claim 11 (currently amended): An infrared lamp in accordance with claim 10, wherein said heating element assembly is inserted into a heat-resistant transparent glass tube, said intermediate terminal plates are sealed in sealing portions of said heat-resistant transparent glass tube, and external lead wires ~~extended~~ extending outside said heat-resistant transparent glass tube are connected to ~~the other~~ ends of said intermediate terminal ~~plates~~ plate.

Claim 12 (currently amended): An infrared lamp comprising:

~~electrode terminals disposed at both ends of each of a plurality of heating elements each formed of a sintered body including a carbon-based substance~~

electrically-conductive, heat-radiating electrode terminals disposed at both ends of each of the plurality of heating elements wherein said electrode terminals have a recess portion into

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which said plurality of heating element are inserted, and

a heating element assembly obtained by connecting at least one electrode terminal of a heating element to at least one electrode terminal of another heating element via a connection terminal thereby ~~to form~~ forming a long heating element, by connecting said electrode terminals at both ends of said long heating element to one ~~ends~~ end of internal lead wires, and by connecting the other ~~ends~~ end of said internal lead wires to intermediate terminal plates.

Claim 13 (currently amended): An infrared lamp in accordance with claim 12, wherein said heating element assembly is inserted into a heat-resistant transparent glass tube, said intermediate terminal plates are sealed at ~~the~~ sealing portions of said heat-resistant transparent glass tube, and external lead wires ~~extended~~ extending outside said heat-resistant transparent glass tube are connected to the other ends of said intermediate terminal plates.

Claim 14 (currently amended): An infrared lamp in accordance with claim 12, wherein at least one of said connection terminal ~~or~~ and said electrode terminals are formed of a sintered body including a carbon-based substance.

Claim 15 (currently amended): An infrared lamp in accordance with claim 12, wherein said connection terminal is formed from ~~of~~ at least one of a coil-shaped tungsten-based substance and ~~or~~ a coil-shaped molybdenum-based substance.

Claim 16 (currently amended): An infrared lamp in accordance with claim 13, wherein said heat-resistant transparent glass tube enclosing said heating element is filled with a gas selected from the group consisting of ~~including at least~~ an inert gas ~~substance or a~~ and nitrogen gas ~~substance~~.

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Claim 17 (currently amended): An infrared lamp in accordance with claim 14, wherein said connection terminal has a shape being concentric with said heating element and said heat-resistant transparent glass tube, and is disposed so that a predetermined clearance is provided between said connection terminal and an the inner wall of said heat-resistant transparent glass tube.

Claim 18 (original): An infrared lamp in accordance with claim 10, wherein said heating element assembly is formed of a plurality of heating elements having different heating values.

Claim 19 (currently amended): An infrared lamp comprising:

a long heating element obtained by connecting a plurality of heating elements, in series via connection terminals, said heating elements being formed of a sintered body including a carbon-based substance,

electrode terminals connected to both ends of said long heating element, and

a heating element assembly obtained by electrically connecting one end of internal lead wires to said electrode terminals and by connecting the another end of said internal lead wires to one end of intermediate terminal plates, in accordance with claim 10; wherein said heating element is a plate-shaped heating element, the cross-sectional shape of said plate-shaped heating element is a rectangle, the ratio of the thickness to the width of the rectangle is 1:5 or more, and the direction of the longer side of the rectangular cross-section of at least one of said plurality of plate-shaped heating elements is different from those of the other plate-shaped heating elements.

Claims 20-22 (cancelled)

Claim 23 (currently amended): An infrared lamp comprising:

a heating element assembly obtained by installing a plurality of terminals on at least one wire-shaped long heating element formed of a sintered body including a carbon-based substance,

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~~by connecting a pair of~~

electrode terminals connected to both ends of said ~~long~~ heating element, ~~by electrically connecting one ends of and,~~

internal lead wires connected on one end to said electrode terminals and connected on another end ~~by connecting the other ends of said internal lead wires to one ends of~~ intermediate terminal plates.

Claim 24 (currently amended): An infrared lamp in accordance with claim 23, wherein said heating element assembly is inserted into a ~~said~~ heat-resistant transparent glass tube, said intermediate terminal plates are sealed at the sealing portions of said heat-resistant transparent glass tube, and external lead wires ~~extended~~ extending outside said heat-resistant transparent glass tube are connected to the other ends of said intermediate terminal plates.

Claim 25 (original): An infrared lamp in accordance with claim 1, wherein more carbon is contained in the surface layer than in the inside of said heating element.

Claim 26 (currently amended): A warming apparatus provided with a plurality of ~~said~~ infrared lamps in accordance with claim 25 at in at least one of the upper, lower ~~or~~ and side positions of the housing of said apparatus ~~or at said plurality of positions of said housing.~~

Claim 27 (currently amended): A drying apparatus provided with a plurality of ~~said~~ infrared lamps in accordance with claim 25 at in at least one of the upper, lower ~~or~~ and side positions of the housing of said apparatus ~~or at said plurality of positions of said housing.~~

Claim 28 (currently amended): A heating apparatus provided with a plurality of ~~said~~ infrared lamps in accordance with claim 25 at in at least one of the upper, lower ~~or~~ and side positions of the housing of said apparatus ~~or at said plurality of positions of said housing.~~

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Claim 29 (currently amended): A cooking apparatus provided with a plurality of ~~said~~ infrared lamps in accordance with claim 25 ~~at~~ in at least one of the upper, lower ~~or~~ and side positions of the housing of said apparatus ~~or at said plurality of positions of said housing.~~

Claim 30 (currently amended): A medical apparatus provided with a plurality of ~~said~~ infrared lamps in accordance with claim 25 ~~at~~ in at least one of the upper, lower ~~or~~ and side positions of the housing of said apparatus ~~or at said plurality of positions of said housing.~~